

## Gunter, Jason

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**From:** James, Kevin <kjames@doerun.com>  
**Sent:** Wednesday, December 10, 2014 11:52 PM  
**To:** Gunter, Jason  
**Cc:** Yingling, Mark; Neaville, Chris; Montgomery, Michael; 'robert.hinkson@dnr.mo.gov'; 'brandon.wiles@dnr.mo.gov'; 'Ty Morris (TMorris@barr.com)'  
**Subject:** Leadwood Progress Report - November  
**Attachments:** removed.txt; 2014-11-19 LW NPDES Pace Lab Report.pdf; Leadwood\_ProgressReport-Nov2014.pdf; Remediation Air Report with 4thQ Audit - October 2014.pdf

Jason -

Attached is the November Progress Report for the Leadwood Site.

Best regards,

Kevin James

**Kevin James**



Environmental Engineering  
W: 573.626.2096  
C: 573.247.6766

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Pace Analytical Services, Inc.  
9608 Loiret Blvd.  
Lenexa, KS 66219  
(913)599-5665

December 01, 2014

Amy Sanders  
The Doe Run Company  
P. O. Box 500  
Viburnum, MO 65566

RE: Project: NPDES (LEADWOOD)  
Pace Project No.: 60182949

Dear Amy Sanders:

Enclosed are the analytical results for sample(s) received by the laboratory on November 20, 2014. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church  
jamie.church@pacelabs.com  
Project Manager

Enclosures



## REPORT OF LABORATORY ANALYSIS

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## CERTIFICATIONS

Project: NPDES (LEADWOOD)

Pace Project No.: 60182949

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### Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219

WY STR Certification #: 2456.01

Arkansas Certification #: 13-012-0

Illinois Certification #: 003097

Iowa Certification #: 118

Kansas/NELAP Certification #: E-10116

Louisiana Certification #: 03055

Nevada Certification #: KS000212008A

Oklahoma Certification #: 9205/9935

Texas Certification #: T104704407

Utah Certification #: KS00021

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## SAMPLE SUMMARY

Project: NPDES (LEADWOOD)

Pace Project No.: 60182949

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60182949001	23065 / LEADWOOD DOWNSTREAM	Water	11/19/14 09:11	11/20/14 06:20
60182949002	23066 / LEADWOOD UPSTREAM	Water	11/19/14 08:54	11/20/14 06:20
60182949003	23067 / LEADWOOD 001	Water	11/19/14 08:32	11/20/14 06:20
60182949004	23068 / LEADWOOD 002	Water	11/19/14 08:13	11/20/14 06:20

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## SAMPLE ANALYTE COUNT

Project: NPDES (LEADWOOD)

Pace Project No.: 60182949

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60182949001	23065 / LEADWOOD DOWNSTREAM	EPA 200.7	NDJ	6	PASI-K
		EPA 200.7	NDJ	3	PASI-K
		SM 2540D	JMC1	1	PASI-K
		EPA 300.0	OL	1	PASI-K
60182949002	23066 / LEADWOOD UPSTREAM	EPA 200.7	NDJ	6	PASI-K
		EPA 200.7	NDJ	3	PASI-K
		SM 2540D	JMC1	1	PASI-K
		EPA 300.0	OL	1	PASI-K
60182949003	23067 / LEADWOOD 001	EPA 200.7	NDJ	3	PASI-K
		SM 2540D	JMC1	1	PASI-K
		SM 2540F	JML	1	PASI-K
		EPA 300.0	OL	1	PASI-K
60182949004	23068 / LEADWOOD 002	EPA 200.7	NDJ	3	PASI-K
		SM 2540D	JMC1	1	PASI-K
		SM 2540F	JML	1	PASI-K
		EPA 300.0	OL	1	PASI-K

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## ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)

Pace Project No.: 60182949

**Sample: 23065 / LEADWOOD**      **Lab ID: 60182949001**      Collected: 11/19/14 09:11      Received: 11/20/14 06:20      Matrix: Water  
**DOWNSTREAM**

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
<b>200.7 Metals, Total</b> Analytical Method: EPA 200.7      Preparation Method: EPA 200.7									
Cadmium	ND	ug/L	5.0	0.56	1	11/22/14 10:44	11/24/14 17:13	7440-43-9	
Calcium	<b>50200</b>	ug/L	100	7.8	1	11/22/14 10:44	11/24/14 17:13	7440-70-2	
Lead	ND	ug/L	5.0	2.2	1	11/22/14 10:44	11/24/14 17:13	7439-92-1	
Magnesium	<b>30300</b>	ug/L	50.0	17.0	1	11/22/14 10:44	11/24/14 17:13	7439-95-4	
Total Hardness by 2340B	<b>250000</b>	ug/L	500		1	11/22/14 10:44	11/24/14 17:13		
Zinc	<b>17.7J</b>	ug/L	50.0	12.5	1	11/22/14 10:44	11/24/14 17:13	7440-66-6	
<b>200.7 Metals, Dissolved (LF)</b> Analytical Method: EPA 200.7      Preparation Method: EPA 200.7									
Cadmium, Dissolved	ND	ug/L	5.0	0.56	1	11/22/14 16:30	11/24/14 11:48	7440-43-9	
Lead, Dissolved	ND	ug/L	5.0	2.2	1	11/22/14 16:30	11/24/14 11:48	7439-92-1	
Zinc, Dissolved	<b>13.3J</b>	ug/L	50.0	12.5	1	11/22/14 16:30	11/24/14 11:48	7440-66-6	
<b>2540D Total Suspended Solids</b> Analytical Method: SM 2540D									
Total Suspended Solids	<b>14.0</b>	mg/L	5.0	5.0	1		11/25/14 13:56		D6
<b>300.0 IC Anions 28 Days</b> Analytical Method: EPA 300.0									
Sulfate	<b>35.3</b>	mg/L	5.0	2.5	5		11/25/14 13:43	14808-79-8	

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## ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)  
Pace Project No.: 60182949

Sample: 23066 / LEADWOOD UPSTREAM Lab ID: 60182949002 Collected: 11/19/14 08:54 Received: 11/20/14 06:20 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
<b>200.7 Metals, Total</b> Analytical Method: EPA 200.7 Preparation Method: EPA 200.7									
Cadmium	ND	ug/L	5.0	0.56	1	11/22/14 10:44	11/24/14 17:23	7440-43-9	
Calcium	46600	ug/L	100	7.8	1	11/22/14 10:44	11/24/14 17:23	7440-70-2	
Lead	ND	ug/L	5.0	2.2	1	11/22/14 10:44	11/24/14 17:23	7439-92-1	
Magnesium	29200	ug/L	50.0	17.0	1	11/22/14 10:44	11/24/14 17:23	7439-95-4	
Total Hardness by 2340B	237000	ug/L	500		1	11/22/14 10:44	11/24/14 17:23		
Zinc	ND	ug/L	50.0	12.5	1	11/22/14 10:44	11/24/14 17:23	7440-66-6	
<b>200.7 Metals, Dissolved (LF)</b> Analytical Method: EPA 200.7 Preparation Method: EPA 200.7									
Cadmium, Dissolved	ND	ug/L	5.0	0.56	1	11/22/14 16:30	11/24/14 11:54	7440-43-9	
Lead, Dissolved	ND	ug/L	5.0	2.2	1	11/22/14 16:30	11/24/14 11:54	7439-92-1	
Zinc, Dissolved	ND	ug/L	50.0	12.5	1	11/22/14 16:30	11/24/14 11:54	7440-66-6	
<b>2540D Total Suspended Solids</b> Analytical Method: SM 2540D									
Total Suspended Solids	7.0	mg/L	5.0	5.0	1		11/25/14 13:57		
<b>300.0 IC Anions 28 Days</b> Analytical Method: EPA 300.0									
Sulfate	22.0	mg/L	2.0	1.0	2		11/25/14 14:31	14808-79-8	

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## ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)

Pace Project No.: 60182949

Sample: 23067 / LEADWOOD 001 Lab ID: 60182949003 Collected: 11/19/14 08:32 Received: 11/20/14 06:20 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
<b>200.7 Metals, Total</b> Analytical Method: EPA 200.7 Preparation Method: EPA 200.7									
Cadmium	1.5J	ug/L	5.0	0.56	1	11/22/14 10:44	11/24/14 17:26	7440-43-9	
Lead	9.2	ug/L	5.0	2.2	1	11/22/14 10:44	11/24/14 17:26	7439-92-1	
Zinc	2730	ug/L	50.0	12.5	1	11/22/14 10:44	11/24/14 17:26	7440-66-6	
<b>2540D Total Suspended Solids</b> Analytical Method: SM 2540D									
Total Suspended Solids	7.0	mg/L	5.0	5.0	1		11/25/14 13:57		
<b>2540F Total Settleable Solids</b> Analytical Method: SM 2540F									
Total Settleable Solids	ND	mL/L/hr	0.20	0.20	1		11/20/14 16:00		
<b>300.0 IC Anions 28 Days</b> Analytical Method: EPA 300.0									
Sulfate	352	mg/L	50.0	25.0	50		11/25/14 15:18	14808-79-8	

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## ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)

Pace Project No.: 60182949

Sample: 23068 / LEADWOOD 002		Lab ID: 60182949004		Collected: 11/19/14 08:13		Received: 11/20/14 06:20		Matrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
<b>200.7 Metals, Total</b>		Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Cadmium	4.7J	ug/L	5.0	0.56	1	11/22/14 10:44	11/24/14 17:28	7440-43-9	
Lead	10.6	ug/L	5.0	2.2	1	11/22/14 10:44	11/24/14 17:28	7439-92-1	
Zinc	5080	ug/L	50.0	12.5	1	11/22/14 10:44	11/24/14 17:28	7440-66-6	
<b>2540D Total Suspended Solids</b>		Analytical Method: SM 2540D							
Total Suspended Solids	6.0	mg/L	5.0	5.0	1		11/25/14 13:57		
<b>2540F Total Settleable Solids</b>		Analytical Method: SM 2540F							
Total Settleable Solids	ND	mL/L/hr	0.20	0.20	1		11/20/14 16:00		
<b>300.0 IC Anions 28 Days</b>		Analytical Method: EPA 300.0							
Sulfate	472	mg/L	50.0	25.0	50		11/25/14 15:34	14808-79-8	

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## QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)

Pace Project No.: 60182949

QC Batch: MPRP/29935

Analysis Method: EPA 200.7

QC Batch Method: EPA 200.7

Analysis Description: 200.7 Metals, Total

Associated Lab Samples: 60182949001, 60182949002, 60182949003, 60182949004

METHOD BLANK: 1484231

Matrix: Water

Associated Lab Samples: 60182949001, 60182949002, 60182949003, 60182949004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Cadmium	ug/L	ND	5.0	11/24/14 17:08	
Calcium	ug/L	ND	100	11/24/14 17:08	
Lead	ug/L	ND	5.0	11/24/14 17:08	
Magnesium	ug/L	ND	50.0	11/24/14 17:08	
Total Hardness by 2340B	ug/L	ND	500	11/24/14 17:08	
Zinc	ug/L	ND	50.0	11/24/14 17:08	

LABORATORY CONTROL SAMPLE: 1484232

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Cadmium	ug/L	1000	1020	102	85-115	
Calcium	ug/L	10000	9240	92	85-115	
Lead	ug/L	1000	996	100	85-115	
Magnesium	ug/L	10000	9290	93	85-115	
Total Hardness by 2340B	ug/L		61300			
Zinc	ug/L	1000	1010	101	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1484233 1484234

Parameter	Units	60182949001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Cadmium	ug/L	ND	1000	1000	1030	1040	103	104	70-130	0	20	
Calcium	ug/L	50200	10000	10000	59000	59500	88	93	70-130	1	20	
Lead	ug/L	ND	1000	1000	992	1000	99	100	70-130	1	20	
Magnesium	ug/L	30300	10000	10000	39500	40000	92	96	70-130	1	20	
Total Hardness by 2340B	ug/L	250000			310000	313000				1		
Zinc	ug/L	17.7J	1000	1000	1000	1010	98	99	70-130	1	20	

MATRIX SPIKE SAMPLE: 1484235

Parameter	Units	60182950001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Cadmium	ug/L	2.6J	1000	1050	105	70-130	
Calcium	ug/L	116000	10000	125000	87	70-130	
Lead	ug/L	5.1	1000	1010	100	70-130	
Magnesium	ug/L	46800	10000	56500	97	70-130	
Total Hardness by 2340B	ug/L	483000		545000			
Zinc	ug/L	3180	1000	4150	96	70-130	

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## QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)

Pace Project No.: 60182949

QC Batch: MPRP/29925

Analysis Method: EPA 200.7

QC Batch Method: EPA 200.7

Analysis Description: 200.7 Metals, Dissolved

Associated Lab Samples: 60182949001, 60182949002

METHOD BLANK: 1484022

Matrix: Water

Associated Lab Samples: 60182949001, 60182949002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Cadmium, Dissolved	ug/L	ND	5.0	11/24/14 11:43	
Lead, Dissolved	ug/L	ND	5.0	11/24/14 11:43	
Zinc, Dissolved	ug/L	ND	50.0	11/24/14 11:43	

LABORATORY CONTROL SAMPLE: 1484023

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Cadmium, Dissolved	ug/L	1000	997	100	85-115	
Lead, Dissolved	ug/L	1000	988	99	85-115	
Zinc, Dissolved	ug/L	1000	959	96	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1484024 1484025

Parameter	Units	60182949001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Cadmium, Dissolved	ug/L	ND	1000	1000	1000	992	100	99	70-130	1	20	
Lead, Dissolved	ug/L	ND	1000	1000	985	978	99	98	70-130	1	20	
Zinc, Dissolved	ug/L	13.3J	1000	1000	955	945	94	93	70-130	1	20	

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## QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)

Pace Project No.: 60182949

QC Batch: WET/51737 Analysis Method: SM 2540D  
QC Batch Method: SM 2540D Analysis Description: 2540D Total Suspended Solids  
Associated Lab Samples: 60182949001, 60182949002, 60182949003, 60182949004

METHOD BLANK: 1485075 Matrix: Water  
Associated Lab Samples: 60182949001, 60182949002, 60182949003, 60182949004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Suspended Solids	mg/L	ND	5.0	11/25/14 13:54	

SAMPLE DUPLICATE: 1485076

Parameter	Units	60182933003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Suspended Solids	mg/L	17.0	12.0	34	10	D6

SAMPLE DUPLICATE: 1485077

Parameter	Units	60182949001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Suspended Solids	mg/L	14.0	11.0	24	10	D6

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### QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)  
Pace Project No.: 60182949

QC Batch: WETA/31950 Analysis Method: EPA 300.0  
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions  
Associated Lab Samples: 60182949001, 60182949002, 60182949003, 60182949004

METHOD BLANK: 1484175 Matrix: Water  
Associated Lab Samples: 60182949001, 60182949002, 60182949003, 60182949004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	1.0	11/25/14 13:11	

LABORATORY CONTROL SAMPLE: 1484176

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	5	4.9	98	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1484177 1484178

Parameter	Units	60182949001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	35.3	25	25	60.4	59.5	100	97	80-120	1	15	

MATRIX SPIKE SAMPLE: 1484179

Parameter	Units	60183029007 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	587	250	949	145	80-120	M1

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## QUALIFIERS

Project: NPDES (LEADWOOD)

Pace Project No.: 60182949

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### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

### LABORATORIES

PASI-K Pace Analytical Services - Kansas City

### ANALYTE QUALIFIERS

D6 The relative percent difference (RPD) between the sample and sample duplicate exceeded laboratory control limits.

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

## REPORT OF LABORATORY ANALYSIS

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## QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: NPDES (LEADWOOD)  
Pace Project No.: 60182949

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60182949001	23065 / LEADWOOD DOWNSTREAM	EPA 200.7	MPRP/29935	EPA 200.7	ICP/22408
60182949002	23066 / LEADWOOD UPSTREAM	EPA 200.7	MPRP/29935	EPA 200.7	ICP/22408
60182949003	23067 / LEADWOOD 001	EPA 200.7	MPRP/29935	EPA 200.7	ICP/22408
60182949004	23068 / LEADWOOD 002	EPA 200.7	MPRP/29935	EPA 200.7	ICP/22408
60182949001	23065 / LEADWOOD DOWNSTREAM	EPA 200.7	MPRP/29925	EPA 200.7	ICP/22406
60182949002	23066 / LEADWOOD UPSTREAM	EPA 200.7	MPRP/29925	EPA 200.7	ICP/22406
60182949001	23065 / LEADWOOD DOWNSTREAM	SM 2540D	WET/51737		
60182949002	23066 / LEADWOOD UPSTREAM	SM 2540D	WET/51737		
60182949003	23067 / LEADWOOD 001	SM 2540D	WET/51737		
60182949004	23068 / LEADWOOD 002	SM 2540D	WET/51737		
60182949003	23067 / LEADWOOD 001	SM 2540F	WET/51655		
60182949004	23068 / LEADWOOD 002	SM 2540F	WET/51655		
60182949001	23065 / LEADWOOD DOWNSTREAM	EPA 300.0	WETA/31950		
60182949002	23066 / LEADWOOD UPSTREAM	EPA 300.0	WETA/31950		
60182949003	23067 / LEADWOOD 001	EPA 300.0	WETA/31950		
60182949004	23068 / LEADWOOD 002	EPA 300.0	WETA/31950		

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# Sample Condition Upon Receipt

## WO#: 60182949



60182949

Client Name: DRC

Courier: Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other ☒ VIA

Tracking #: \_\_\_\_\_ Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☒ 22PIC

Thermometer Used: T-239 / T-194

Type of Ice: ☒ Wet ☐ Blue ☐ None ☐ Samples received on ice, cooling process has begun.  
(circle one)

Cooler Temperature: 2-6

Date and initials of person examining contents: PR 11/20/14

Temperature should be above freezing to 6°C

Chain of Custody present:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	1.
Chain of Custody filled out:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	2.
Chain of Custody relinquished:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	3.
Sampler name & signature on COC:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	4.
Samples arrived within holding time:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	5.
Short Hold Time analyses (<72hr):	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	6. <u>S.S</u>
Rush Turn Around Time requested:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	7.
Sufficient volume:	<u>James Church</u>	
Correct containers used:	<u>James Church</u>	
Pace containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	9.
Containers intact:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	10.
Unpreserved 5035A soils frozen w/in 48hrs?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	11.
Filtered volume received for dissolved tests?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	12.
Sample labels match COC:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Includes date/time/ID/analyses Matrix:	<u>NT</u>	13.
All containers needing preservation have been checked.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
All containers needing preservation are found to be in compliance with EPA recommendation.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	14.
Exceptions: VOA, coliform, TOC, O&G, WI-DRO (water), Phenolics	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Initial when completed
Trip Blank present:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Lot # of added preservative
Pace Trip Blank lot # (if purchased):		15.
Headspace in VOA vials (>6mm):	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	16.
Project sampled in USDA Regulated Area:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	17. List State:

Client Notification/ Resolution:

Copy COC to Client? Y / N

Field Data Required? Y / N

Person Contacted: \_\_\_\_\_

Date/Time: \_\_\_\_\_

Comments/ Resolution: \_\_\_\_\_

Project Manager Review: \_\_\_\_\_

Date: 11/20/14



### Section C

**Invoice Information:**

Company: The Doe Run Company		Report To: Amy Sanders	Attention: Amy Sanders	REGULATORY AGENCY		Page: 1 of 1
Address: PO Box 500		Copy To:	Company Name: The Doe Run Company	<input type="checkbox"/> NPDES <input type="checkbox"/> GROUND WATER <input type="checkbox"/> UST <input type="checkbox"/> RCRA		COC#: 1082  6018274
Email To: asanders@doerun.com		Purchase Order No.:	Address: PO Box 500, Viburnum, MO 65568			
Phone: (573) 689-4535	Fax: (573) 244-8179	Project Name: NPDES (Leadwood)	Pace Quote Reference:	Site Location		
Requested Due Date/TAT: 5 To 7 Days	Project Number:	Pace Project Manager:	Pace Profile #:	STATE: MO		

Requested Analysis Filtered (Y/N)

[illegible]

**SAMPLER NAME AND SIGNATURE**

PRINT Name of SAMPLER:

**Larry Hopkins**

**SIGNATURE of SAMPLER:**

DATE Signed \_\_\_\_\_

11/19/14

Temp in °C

**pH 4.5**

Received on

Custody	
(N/A)	

Sealed Cooler  
(Y/N)

**THE  
DOE RUN  
COMPANY**

*Remediation Group*

**Kevin James**  
**Environmental Engineering Supervisor**  
**kjames@doerun.com**

December 10, 2014

Mr. Jason Gunter  
Remedial Project Manager  
U.S. Environmental Protection Agency  
Region 7 - Superfund Branch  
11201 Renner Blvd.  
Lenexa, KS 66219

**Re: The Doe Run Company - Leadwood Mine Tailings Site Monthly Progress Report**

Dear Mr. Gunter:

As required by Article VI, Section 50 of the Unilateral Administrative Order (Docket No. CERCLA-07-2006-0272) for the referenced project and on behalf of The Doe Run Company, the progress report for the period November 1, 2014 through November 30, 2014 is enclosed. If you have any questions or comments, please call me at 573-626-2096.

Sincerely,



Kevin James  
Environmental Engineering Supervisor

Enclosures

- c: Mark Yingling – TDRC (electronic only)  
Chris Neaville – TDRC (electronic only)  
Michael Montgomery – TDRC (electronic only)  
Brandon Wiles – MDNR  
Ty Morris – Barr Engineering

**Leadwood Mine Tailings Site**  
Leadwood, Missouri  
**Removal Action - Monthly Progress Report**  
Period: November 1, 2014 – November 30, 2014

**1. Actions Performed or Completed This Period:**

- a. Work continued on the development of the Post Removal Site Control Plan for the site.
- b. Work on the implementation of the surface water management plan also included applying the low permeability soil cover to the designated area. As of the end of the period, the work on this task was completed.

**2. Data and Results Received This Period:**

- a. During this period, water samples were collected from downstream of Leadwood Dam and the East Seep and Erosion Area, as well as from upstream and downstream of the confluence of Eaton Creek with Big River. The analytical results for this event are included with this progress report.
- b. During this period, the ambient air monitoring samples for October were processed and the Ambient Air Monitoring Report for October 2014 was completed. A copy of the Ambient Air Monitoring Report for October is attached.
- c. During this period the quarterly audits of the monitors and the semi-annual audit of the meteorological system was completed. A copy of the 4<sup>th</sup> Quarter 2013 Lead/PM10 Samplers and Meteorological System Performance Audit Report is attached.

**3. Scheduled Activities not Completed This Period:**

- a. None.

**4. Planned Activities for Next Period:**

- a. Continue developing the Post Removal Site Control Plan for the site.
- b. Complete monthly water sampling activities as described in the Removal Action Work Plan.
- c. Complete air monitoring activities as described in the Removal Action Work Plan.

**5. Changes in Personnel:**

- a. Mark Nations has retired from The Doe Run Company and will no longer act as the Project Coordinator.
- b. Kevin James will now be the Project Coordinator for The Doe Run Company. In accordance with Section VII, Paragraph 66, of the above referenced Unilateral Administrative Order this will serve as the written notice of the change in Project Coordinators.
- c. The following members of the remediation group working in the Old Lead Belt region have been transferred to positions at the active mining and milling operations - Chris Rawlins, Jimmie Minx, Keith Bates, Adam Mills, and Steve Sadler.

**6. Issues or Problems Arising This Period:**

- a. None.

**7. Resolution of Issues or Problems Arising This Period:**

- a. None.

# **Monthly Ambient Air Monitoring Report**

The Doe Run Company  
Old Lead Belt Sites:  
Federal, Rivermines, National, and Leadwood

**October-2014**



SUITE 300  
1801 PARK 270 DRIVE  
ST. LOUIS, MO 63146

## Federal Site

Sample Results for **October-2014**

	St. Joe (Ballfields)		Big River#4		Water Treatment Plant	
Sample Date	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
10/1/14	39	0.021	35	0.014	39	0.007
10/2/14	12	0.007	8	0.007	13	0.028
10/3/14	12	0.007	10	0.000	15	0.028
10/6/14	9	0.007	3	0.007	7	0.021
10/7/14	15	0.007	11	0.014	13	0.049
10/8/14	13	0.014	21	0.013	16	0.014
10/9/14	7	0.000	12	0.007	12	0.007
10/10/14	3	0.000	43	0.007	3	0.000
10/13/14	2	0.000	2	0.000	2	0.000
10/14/14	5	0.000	0	0.007	1	0.000
10/15/14	5	0.007	4	0.007	6	0.021
10/16/14	15	0.138	12	0.007	14	0.021
10/17/14	27	0.021	25	0.007	28	0.078
10/20/14	27	0.041	20	0.007	23	0.055
10/21/14	22	0.014	26	0.007	52	0.156
10/22/14	15	0.013	15	0.007	31	0.094
10/23/14	14	0.149	10	0.013	37	0.068
10/24/14	12	0.021	14	0.013	20	0.041
10/27/14	93	0.141	30	0.007	44	0.049
10/28/14	13	0.007	8	0.007	6	0.021
10/29/14	9	0.007	15	0.013	10	0.020
10/30/14	12	0.034	10	0.013	6	0.007
10/31/14	21	0.007	14	0.000	17	0.007

Monthly Avg. TSP	17	15	18
Monthly Avg. Pb	0.029	0.008	0.034
Sep-14	0.009	0.013	0.017
Aug-14	0.014	0.019	0.024
<b>Rolling 3-Month</b>	<b>0.017</b>	<b>0.014</b>	<b>0.025</b>

*Three month rolling average must be less than 0.15 ug/m3*

### NOTES:

	Big River QA	
Sample Date	TSP ug/m3	Lead ug/m3
10/2/14	10	0.007
10/7/14	12	0.007
10/9/14	28	0.007
10/14/14	0	0.000
10/16/14	12	0.007
10/21/14	23	0.007
10/23/14	8	0.007
10/28/14	9	0.007
10/30/14	12	0.013

## Rivermines

Sample Results for **October-2014**

Sample Date	Big River #4		Rivermines South #1		Rivermines North #2		Rivermines East #3	
	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
10/1/14	35	0.014	38	0.014	invalid	invalid	39	0.007
10/2/14	8	0.007	invalid	invalid	6	0.035	13	0.028
10/3/14	10	0.000	13	0.006	11	0.000	15	0.028
10/6/14	3	0.007	5	0.007	7	0.021	7	0.021
10/7/14	11	0.014	20	0.062	19	0.077	13	0.049
10/8/14	21	0.013	24	0.054	17	0.007	16	0.014
10/9/14	12	0.007	11	0.007	20	0.000	12	0.007
10/10/14	43	0.007	5	0.000	3	0.000	3	0.000
10/13/14	2	0.000	0	0.000	4	0.007	2	0.000
10/14/14	0	0.007	0	0.000	1	0.007	1	0.000
10/15/14	4	0.007	10	0.013	5	0.041	6	0.021
10/16/14	12	0.007	12	0.007	17	0.042	14	0.021
10/17/14	25	0.007	33	0.026	21	0.000	28	0.078
10/20/14	20	0.007	31	0.047	20	0.007	23	0.055
10/21/14	26	0.007	73	0.405	23	0.007	52	0.156
10/22/14	15	0.007	17	0.033	11	0.020	31	0.094
10/23/14	10	0.013	23	0.066	10	0.014	37	0.068
10/24/14	14	0.013	30	0.052	12	0.021	20	0.041
10/27/14	30	0.007	34	0.014	41	0.233	44	0.049
10/28/14	8	0.007	18	0.047	9	0.014	6	0.021
10/29/14	15	0.013	26	0.078	7	0.007	10	0.020
10/30/14	10	0.013	12	0.013	18	0.094	6	0.007
10/31/14	14	0.000	68	0.324	17	0.007	17	0.007

Monthly Avg. TSP	15	23	14	18
Monthly Avg. Pb	0.008	0.058	0.030	0.034
Sep-14	0.013	0.051	0.032	0.017
Aug-14	0.019	0.087	0.043	0.024
<b>Rolling 3-Month</b>	<b>0.014</b>	<b>0.065</b>	<b>0.035</b>	<b>0.025</b>

Three month rolling average must be less than 0.15 ug/m3

**NOTES:** Rivermines North - 10/1, <23hr run time  
Rivermines South - 10/2, <23hr run time, motor bearing failure

Sample Date	Big River QA	
	TSP ug/m3	Lead ug/m3
10/2/14	10	0.007
10/7/14	12	0.007
10/9/14	28	0.007
10/14/14	0	0.000
10/16/14	12	0.007
10/21/14	23	0.007
10/23/14	8	0.007
10/28/14	9	0.007
9/30/14	32	0.021

# **National Site**

Sample Results for **October-2014**

	Big River #4		Ozark #1		Soccer Park #2		Water Treatment Plant	
Sample Date	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
10/1/14	35	0.014	48	0.014	46	0.021	39	0.007
10/2/14	8	0.007	10	0.007	11	0.007	13	0.028
10/3/14	10	0.000	11	0.000	13	0.000	15	0.028
10/6/14	3	0.007	invalid	invalid	10	0.021	7	0.021
10/7/14	11	0.014	invalid	invalid	14	0.021	13	0.049
10/8/14	21	0.013	invalid	invalid	18	0.014	16	0.014
10/9/14	12	0.007	invalid	invalid	8	0.007	12	0.007
10/10/14	43	0.007	3	0.000	5	0.000	3	0.000
10/13/14	2	0.000	2	0.000	2	0.007	2	0.000
10/14/14	0	0.007	2	0.000	1	0.000	1	0.000
10/15/14	4	0.007	11	0.020	9	0.021	6	0.021
10/16/14	12	0.007	27	0.014	24	0.014	14	0.021
10/17/14	25	0.007	39	0.007	31	0.007	28	0.078
10/20/14	20	0.007	29	0.007	25	0.014	23	0.055
10/21/14	26	0.007	27	0.014	26	0.014	52	0.156
10/22/14	15	0.007	18	0.007	18	0.013	31	0.094
10/23/14	10	0.013	17	0.013	20	0.014	37	0.068
10/24/14	14	0.013	15	0.014	18	0.021	20	0.041
10/27/14	30	0.007	43	0.028	43	0.035	44	0.049
10/28/14	8	0.007	9	0.007	11	0.014	6	0.021
10/29/14	15	0.013	16	0.007	11	0.007	10	0.020
10/30/14	10	0.013	11	0.007	16	0.007	6	0.007
10/31/14	14	0.000	20	0.007	28	0.007	17	0.007

Monthly Avg. TSP	15	19	18	18
Monthly Avg. Pb	0.008	0.009	0.012	0.034
Sep-14	0.013	0.009	0.016	0.017
Aug-14	0.019	0.012	0.015	0.024
<b>Rolling 3-Month</b>	<b>0.014</b>	<b>0.010</b>	<b>0.014</b>	<b>0.025</b>

Three month rolling average must be less than 0.15 ug/m3

**NOTES:** Ozark #1 - 10/6 thru 10/9, <23hr run times - bad GFI breaker replaced.

	Big River QA	
Sample Date	TSP ug/m3	Lead ug/m3
10/2/14	10	0.007
10/7/14	12	0.007
10/9/14	28	0.007
10/14/14	0	0.000
10/16/14	12	0.007
10/21/14	23	0.007
10/23/14	8	0.007
10/28/14	9	0.007
9/30/14	32	0.021

## Leadwood

Sample Results for **October-2014**

Sample Date	Big River #4		Leadwood South #1		Leadwood East #2		Leadwood North #3	
	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
10/1/14	35	0.014	105	0.096	107	0.096	37	0.007
10/2/14	8	0.007	19	0.007	39	0.021	9	0.000
10/3/14	10	0.000	14	0.007	11	0.000	11	0.000
10/6/14	3	0.007	16	0.007	7	0.007	3	0.007
10/7/14	11	0.014	9	0.007	9	0.007	8	0.007
10/8/14	21	0.013	20	0.013	31	0.007	12	0.007
10/9/14	12	0.007	8	0.007	6	0.007	7	0.000
10/10/14	43	0.007	6	0.007	6	0.000	3	0.000
10/13/14	2	0.000	1	0.000	1	0.000	0	0.000
10/14/14	0	0.007	1	0.000	0	0.000	1	0.000
10/15/14	4	0.007	6	0.007	7	0.007	9	0.007
10/16/14	12	0.007	12	0.007	14	0.000	7	0.007
10/17/14	25	0.007	30	0.007	22	0.000	25	0.000
10/20/14	20	0.007	22	0.007	20	0.007	17	0.007
10/21/14	26	0.007	26	0.013	28	0.007	25	0.007
10/22/14	15	0.007	12	0.013	20	0.026	14	0.013
10/23/14	10	0.013	26	0.013	17	0.020	20	0.007
10/24/14	14	0.013	17	0.013	13	0.020	12	0.014
10/27/14	30	0.007	35	0.014	43	0.049	24	0.014
10/28/14	8	0.007	2	0.007	8	0.007	6	0.007
10/29/14	15	0.013	15	0.013	12	0.007	14	0.007
10/30/14	10	0.013	9	0.007	21	0.033	7	0.007
10/31/14	14	0.000	21	0.006	18	0.006	14	0.000

Monthly Avg. TSP	15	19	20	12
Monthly Avg. Pb	0.008	0.012	0.014	0.005
Sep-14	0.013	0.019	0.026	0.006
Aug-14	0.019	0.020	0.026	0.004
<b>Rolling 3-Month</b>	<b>0.014</b>	<b>0.017</b>	<b>0.022</b>	<b>0.005</b>

Three month rolling average must be less than 0.15 ug/m3

### NOTES:

Sample Date	Big River QA	
	TSP ug/m3	Lead ug/m3
10/2/14	10	0.007
10/7/14	12	0.007
10/9/14	28	0.007
10/14/14	0	0.000
10/16/14	12	0.007
10/21/14	23	0.007
10/23/14	8	0.007
10/28/14	9	0.007
9/30/14	32	0.021



## Federal Site

Sample Results for **October-2014**

Sample Date	St. Joe (Ballfields) PM10 (ug/m3)	Big River#4 PM10 (ug/m3)	Water Treatment PM10 (ug/m3)
10/2/14	20	16	18
10/5/14	10	9	9
10/8/14	16	16	11
10/11/14	10	10	9
10/14/14	8	0	0
10/17/14	19	0	23
10/20/14	21	invalid	60
10/23/14	34	19	87
10/26/14	41	98	109
10/29/14	17	127	122

*Compliance with NAAQS is less than 150 ug/m3*

<b>Monthly Avg. PM10</b>	19	33	45
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**NOTES:** Big River #4 - 10/20, <23hr run time, breaker tripped

Sample Date	Big River QA PM10 (ug/m3)
10/2/14	16
10/8/14	16
10/14/14	4
10/20/14	86
10/26/14	103

## Rivermines

Sample Results for **October-2014**

	Big River #4	Rivermines South #1	Rivermines North #2	Rivermines East #3
Sample Date	PM10 (ug/m3)	PM10 (ug/m3)	PM10 (ug/m3)	PM10 (ug/m3)
10/2/14	16	15	12	18
10/5/14	9	8	8	9
10/8/14	16	18	13	11
10/11/14	10	10	10	9
10/14/14	0	1	1	0
10/17/14	0	23	11	23
10/20/14	invalid	36	25	60
10/23/14	19	40	13	87
10/26/14	98	52	102	109
10/29/14	127	53	30	122

*Compliance with NAAQS is less than 150 ug/m3*

<b>Monthly Avg. PM10</b>	33	25	23	45
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**NOTES:** Big River #4 - 10/20, <23hr run time, breaker tripped

	Big River QA
Sample Date	PM10 (ug/m3)
10/2/14	16
10/8/14	16
10/14/14	4
10/20/14	86
10/26/14	103

## National Site

Sample Results for **October-2014**

Sample Date	Big River #4 PM10 (ug/m3)	Ozark #1 PM10 (ug/m3)	Soccer Park #2 PM10 (ug/m3)	Water Treatment PM10 (ug/m3)
10/2/14	16	17	18	18
10/5/14	9	7	11	9
10/8/14	16	14	15	11
10/11/14	10	8	8	9
10/14/14	0	18	0	0
10/17/14	0	16	14	23
10/20/14	invalid	47	30	60
10/23/14	19	21	23	87
10/26/14	98	55	39	109
10/29/14	127	42	9	122

*Compliance with NAAQS is less than 150 ug/m3*

<b>Monthly Avg. PM10</b>	33	25	17	45
--------------------------	----	----	----	----

**NOTES:** Big River #4 - 10/20, <23hr run time, breaker tripped

Sample Date	Big River QA PM10 (ug/m3)
10/2/14	16
10/8/14	16
10/14/14	4
10/20/14	86
10/26/14	103

## Leadwood

Sample Results for **October-2014**

Sample Date	Big River #4 PM10 (ug/m3)	Leadwood South #1 PM10 (ug/m3)	Leadwood East #2 PM10 (ug/m3)	Leadwood North #3 PM10 (ug/m3)
10/2/14	16	18	22	17
10/5/14	9	10	invalid	8
10/8/14	16	12	8	11
10/11/14	10	7	6	9
10/14/14	0	0	0	0
10/17/14	0	24	15	11
10/20/14	invalid	13	29	22
10/23/14	19	19	14	14
10/26/14	98	65	80	32
10/29/14	127	110	36	48

Compliance with NAAQS is less than 150 ug/m3

<b>Monthly Avg. PM10</b>	33	28	23	17
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**NOTES:**

Leadwood East #2 - 10/5, <23hr run time

Big River #4 - 10/20, <23hr run time, breaker tripped

Sample Date	Big River QA PM10 (ug/m3)
10/2/14	16
10/8/14	16
10/14/14	4
10/20/14	86
10/26/14	103

## Meteorological Data - Old Lead Belt

### October-2014

24hr average

Date	Wind Speed (MPH)	Wind Direction	Sigma-Theta	Temperature ( C )	Air Pressure (mmHg)	Rain (Inches)	Power Supply (Volts)
01-Oct-14	4.67	187	26.78	22.17	741	0	13.25
02-Oct-14	4.925	185.9	29.42	22.51	740	1.45	13.21
03-Oct-14	3.539	271.1	37.58	12.99	742	0.05	13.33
04-Oct-14	3.064	246.4	32.88	7.63	744	0	13.43
05-Oct-14	2.394	220	30.94	13.67	739	0	13.41
06-Oct-14	2.142	235	31	15.53	739	0.02	13.35
07-Oct-14	3.264	234	32.05	18.68	741	0.05	13.32
08-Oct-14	2.073	225.9	33.49	16.92	746	0.05	13.31
09-Oct-14	3.122	64.4	37.48	16.87	745	1.46	13.35
10-Oct-14	3.599	16.23	26.59	11.59	746	0.34	13.35
11-Oct-14	3.026	31.6	29.19	11.67	748	0	13.34
12-Oct-14	3.03	162.8	25.03	14.49	742	0.01	13.41
13-Oct-14	7.06	175.4	21.97	18.23	735	0.89	13.35
14-Oct-14	4.24	253.9	31.59	12.42	735	0.17	13.42
15-Oct-14	3.18	288.2	32.12	11.93	741	0	13.44
16-Oct-14	2.731	223.7	27.52	13.92	741	0	13.39
17-Oct-14	3.164	270.8	29.29	15.99	741	0	13.34
18-Oct-14	3.489	319	22.72	10.7	748	0	13.41
19-Oct-14	2.171	222.6	28.51	10.04	749	0	13.44
20-Oct-14	2.729	259.8	24.89	15.51	744	0	13.37
21-Oct-14	2.683	306.1	21.85	12.3	747	0	13.39
22-Oct-14	1.759	122.8	30.13	8.95	751	0	13.44
23-Oct-14	2.34	202.7	24.83	9.58	749	0	13.49
24-Oct-14	1.714	227	33.79	15.21	746	0	13.39
25-Oct-14	1.716	237.2	33.43	18.13	745	0	13.31
26-Oct-14	3.764	181.6	22.62	19.07	743	0	13.31
27-Oct-14	8.51	200.9	20.96	22.19	739	0	13.25
28-Oct-14	4.852	276.6	21.4	15.48	745	0.12	13.32
29-Oct-14	3.147	253.8	23.67	8.25	749	0.89	13.44
30-Oct-14	2.524	215.7	28.6	7.88	746	0.04	13.49
31-Oct-14	8.39	328.9	17.38	5.76	750	0.01	13.51

**INQUEST**  
ENVIRONMENTAL INC.

3609 Mojave Ct., Ste E ♦ COLUMBIA, MO 65202  
(573) 474-8110 ♦ FAX: (573) 474-8371

November 11, 2014

Mr. Greg Henson  
Chemist  
The Doe Run Company  
881 Main Street  
Herculaneum, Missouri 63048

RE: 4th Quarter 2014 Lead/PM10 Samplers and Meteorological System  
Performance Audit Report.

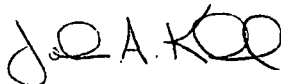
Dear Mr. Henson,

Please find enclosed the worksheets detailing the Lead/PM10 sampler's one-point flow verifications and meteorological sensors accuracy checks that were recently performed on the Doe Run Park Hills Monitoring Network. A copy of the current certifications for the audit devices that were used has also been enclosed.

All of the verifications and checks were found to be within expected guidelines.

After reviewing the enclosed information, please feel free to call with any comments or questions. Thank you for your business.

Sincerely,



John A. Kunkel  
Inquest Environmental, Inc.

## **PM10 Sampler Verifications**

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 Primary PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P2952	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.10	1.067	23.80	44.45	0.942	1.141	6.94	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.30	43.52	0.943	1.142	1.063	-5.93	± 10%

**Calculations:**

Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100



Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 QA PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P1019	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.20	1.084	25.00	46.69	0.939	1.150	6.09	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.80	46.32	0.939	1.150	1.080	-4.42	± 10%

**Calculations:**

Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Ozark Insulation	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P2950	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.20	1.084	23.20	43.33	0.943	1.140	5.17	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.50	43.89	0.943	1.140	1.081	-4.34	± 10%

**Calculations:**

Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	St. Joe Park	Intercept (Qa)	-0.00227
Sampler	#4 PM10	Temperature	23.8 °C 297.0 °K
Flow Controller	P4353	Station Pressure	30.14 "Hg 765.6 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.10	1.062	23.40	43.70	0.943	1.127	6.12	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.50	43.89	0.943	1.158	1.087	-3.81	± 10%

**Calculations:**

Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Hanley Park	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	23.8 °C 297.0 °K
Flow Controller	P2949	Station Pressure	30.13 "Hg 765.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.10	1.062	23.10	43.14	0.944	1.135	6.87	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.20	43.33	0.943	1.158	1.078	-4.60	± 10%

**Calculations:**

Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100

**INQUEST**  
Environmental, Inc.**PM10 Sampler Audit**  
**Volumetric Flow Control**3609 Mojave Court, Suite E  
Columbia, Missouri 65202  
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines (Water Plnt)	Intercept (Qa)	-0.00227
Sampler	#3 PM10	Temperature	23.8 °C 297.0 °K
Flow Controller	P2951	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.20	1.079	23.10	43.14	0.944	1.141	5.75	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.10	43.14	0.944	1.141	1.075	-4.87	± 10%

**Calculations:**Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines (Quarry)	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P4601	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.10	1.066	23.40	43.70	0.943	1.115	4.60	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.116	1.065	-5.75	± 10%

**Calculations:**

Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100

**INQUEST**  
Environmental, Inc.**PM10 Sampler Audit**  
**Volumetric Flow Control**3609 Mojave Court, Suite E  
Columbia, Missouri 65202  
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines (Wood Street)	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	25.0 °C 298.2 °K
Flow Controller	P4507	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.10	1.064	23.40	43.70	0.943	1.132	6.39	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.60	44.08	0.942	1.131	1.059	-6.28	± 10%

**Calculations:**Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood Mill Street	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P1018	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.20	1.084	22.90	42.77	0.944	1.158	6.83	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.158	1.079	-4.51	± 10%

**Calculations:**

Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100



**INQUEST**  
Environmental, Inc.**PM10 Sampler Audit**  
**Volumetric Flow Control**3609 Mojave Court, Suite E  
Columbia, Missouri 65202  
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood (school)	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P6071	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.30	1.101	22.90	42.77	0.944	1.168	6.09	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.168	1.097	-2.92	± 10%

**Calculations:**Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood (south)	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	23.8 °C 297.0 °K
Flow Controller	P1500	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.30	1.097	23.40	43.70	0.943	1.152	5.01	± 7%

Sampler Operating Flow Rate						
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.20	43.33	0.943	1.152	1.094	-3.19	± 10%

**Calculations:**

Pressure mmHg (Pf) - ("H<sub>2</sub>O/13.6) \* 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13\*100

## **Lead/TSP Sampler Verifications**

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River Primary	Intercept (Qa)	-0.00227
Sampler	#4 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P4557	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min.		
3.70	1.165	24.60	45.96	0.940	1.233	5.84	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
24.70	46.15	0.940	1.233	1.161	1.10 - 1.70

**Calculations:**

Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)

Date	<u>October 8, 2014</u>	Auditor	<u>John Kunkel</u>
Operator	<u>The Doe Run Company</u>	Transfer Orifice	<u>1882</u>
Location	<u>Park Hills Network</u>	Slope (Qa)	<u>1.03497</u>
Station	<u>Big River QA</u>	Intercept (Qa)	<u>-0.00227</u>
Sampler	<u>#4 TSP</u>	Temperature	<u>26.1</u> °C <u>299.3</u> °K
Flow Controller	<u>P1019</u>	Station Pressure	<u>30.09</u> "Hg <u>764.3</u> mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.50	1.133	24.20	45.21	0.941	1.153	1.77	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
24.00	44.84	0.941	1.153	1.133	1.10 - 1.70

**Calculations:**

Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	National Ozark Insulation	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P2939	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.70	1.165	23.50	43.91	0.943	1.233	5.84	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
23.40	43.72	0.943	1.233	1.161	1.10 - 1.70

**Calculations:**

Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	St Joe Park	Intercept (Qa)	-0.00227
Sampler	#4 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P6792	Station Pressure	30.14 "Hg 765.6 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.70	1.160	23.30	43.53	0.943	1.224	5.52	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
23.20	43.35	0.943	1.224	<b>1.156</b>	1.10 - 1.70

**Calculations:**

Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Hanley Park	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P4474	Station Pressure	30.13 "Hg 765.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.60	1.144	23.60	44.09	0.942	1.213	6.03	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
23.90	44.65	0.942	1.213	1.140	1.10 - 1.70

**Calculations:**Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)



**INQUEST**  
Environmental, Inc.**Lead Sampler Audit**  
**Volumetric Flow Control**3609 Mojave Court, Suite E  
Columbia, Missouri 65202  
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Water Plant	Intercept (Qa)	-0.00227
Sampler	#3 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P4475	Station Pressure	30.13 "Hg 765.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.60	1.144	23.70	44.28	0.942	1.220	6.64	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.220	1.139	1.10 - 1.70

**Calculations:**Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)

**INQUEST**  
Environmental, Inc.**Lead Sampler Audit**  
**Volumetric Flow Control**3609 Mojave Court, Suite E  
Columbia, Missouri 65202  
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Quarry	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P2940	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.60	1.149	24.10	45.03	0.941	1.227	6.79	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
24.30	45.40	0.941	1.227	1.144	1.10 - 1.70

**Calculations:**Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Wood St.	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	25.0 °C 298.2 °K
Flow Controller	P2941	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.60	1.147	23.80	44.47	0.942	1.227	6.97	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
23.80	44.47	0.942	1.227	1.141	1.10 - 1.70

**Calculations:**

Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood Mill Street	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P1018	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.50	1.133	23.40	43.72	0.943	1.157	2.12	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
23.30	43.53	0.943	1.157	1.132	1.10 - 1.70

**Calculations:**

Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)

**INQUEST**  
Environmental, Inc.**Lead Sampler Audit**  
**Volumetric Flow Control**3609 Mojave Court, Suite E  
Columbia, Missouri 65202  
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood School	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P6793	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.60	1.150	23.30	43.53	0.943	1.223	6.35	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
23.50	43.91	0.943	1.223	1.145	1.10 - 1.70

**Calculations:**Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood South	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P4559	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H <sub>2</sub> O	Flow Rate m <sup>3</sup> /min	Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min		
3.70	1.161	23.80	44.47	0.942	1.237	6.55	± 7%

Sampler Operating Flow Rate					
Manometer "H <sub>2</sub> O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m <sup>3</sup> /min	Corrected Flow Rate	Acceptable Range
23.90	44.65	0.942	1.237	1.156	1.10 - 1.70

**Calculations:**Pressure mmHg (Pf) - "H<sub>2</sub>O \* 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope\*( Sqrt("H<sub>2</sub>O\*( Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow\*100

Corrected Flow Rate - Operating Flow\*((100-Calibration Error)/100)

## **Calibration Orifice Certification Worksheet**



TISCH ENVIRONMENTAL, INC.  
145 SOUTH MIAMI AVE  
VILLAGE OF CLEVELAND, OH  
45002  
513.467.9000  
877.263.7610 TOLL FREE  
513.467.9009 FAX

# ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Jan 09, 2014 Rootsmeter S/N 0438320 Ta (K) - 292  
Operator Tisch Orifice I.D. - 1882 Pa (mm) - 759.46

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3530	4.1	1.50
2	NA	NA	1.00	1.0430	6.8	2.50
3	NA	NA	1.00	0.9510	8.1	3.00
4	NA	NA	1.00	0.8790	9.5	3.50
5	NA	NA	1.00	0.6660	16.3	6.00

## DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
1.0143	0.7496	1.2368	0.9945	0.7350	0.7594
1.0106	0.9690	1.5967	0.9910	0.9501	0.9804
1.0089	1.0608	1.7491	0.9893	1.0402	1.0740
1.0070	1.1456	1.8893	0.9874	1.1233	1.1600
0.9978	1.4983	2.4736	0.9784	1.4691	1.5188
Qstd slope (m) =		1.65282	Qa slope (m) =		1.03497
intercept (b) =		-0.00370	intercept (b) =		-0.00227
coefficient (r) =		0.99999	coefficient (r) =		0.99999
y axis = $\sqrt{H_2O(Pa/760)(298/Ta)}$			y axis = $\sqrt{H_2O(Ta/Pa)}$		

## CALCULATIONS

Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)  
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]  
Qa = Va/Time

For subsequent flow rate calculations:

Qstd =  $1/m\{\sqrt{H_2O(Pa/760)(298/Ta)}\} - b\}$   
Qa =  $1/m\{\sqrt{H_2O(Ta/Pa)}\} - b\}$



## **Meteorological Sensor's Accuracy Checks**

# Inquest Environmental, Inc.

## Wind Direction Sensor Performance Audit

Operator The Doe Run Co  
 Location Big River  
 Station Name Meteorological System  
 Technician M Kunkel / C Boston

Date 10/29/2014  
 Start Time 11:15  
 Stop Time 12:30

Sensor Mfg RM Young  
 Sensor Model Wind Monitor AQ  
 Serial Number 128618  
 Sensor Height 10.0 Meters

Station Declination 0.0 Deg  
 Measured Angle 180.0 Deg  
 Corrected Angle 180.0 Deg  
 Alignment Error 0.0 Deg

Vane Angle Degrees	Data Logger Degrees	Results	
		Difference ± 3 Deg Limit	Total Error ± 5 Deg Limit
0/360	0.6	0.6	0.6
90	89.7	-0.3	-0.3
180	181.1	1.1	1.1
270	270.4	0.4	0.4

Average Difference (Degrees)	0.4
Average Total Error (Degrees)	0.4

Audit Device	Wind Vane Alignment	Direction
Type	Pocket Transit	Vane Angle Fixture
Mfg.	Brunton	R.M. Young
Model	5008	18212
Serial No.	5080304492	None

Comments: Wind direction was verified by determining the orientation of the sensor in respect to True North. This was measured using a tri-pod mounted transit aligned along the length of the sensor while locked from rotating. A magnetic declination of 0 degrees was used to determine True North. The linearity of the sensor was determined by aligning the sensor to an indexed test fixture provided by the manufacturer. The four cardinal directions were verified using the fixture. No adjustments were made to the sensor.

# Inquest Environmental, Inc.

## Wind Speed Sensor Performance Audit

Operator The Doe Run Co  
 Location Big River  
 Station Name Meteorological System  
 Auditor(s) M Kunkel / C Boston

Date 10/29/2014  
 Start Time 11:15  
 Stop Time 12:30

Sensor Mfg RM Young  
 Sensor Model Wind Monitor AQ  
 Serial Number 128618  
 Sensor Height 10.0 Meters

Audit Standard		DAS Response		Limit	± (0.45 MPH + 5%)
RPM	MPH	MPH	Difference	MPH	
Zero	0.00	0.00	0.00	0.45	
300	3.44	3.43	-0.01	0.62	
600	6.87	6.87	0.00	0.79	
1200	13.74	13.74	0.00	1.14	
1800	20.61	20.61	0.00	1.48	
3600	41.22	41.20	-0.02	2.51	
5400	61.83	61.80	-0.03	3.54	
Average			-0.01		

Audit Device	Anemometer Drive
Type	Variable Speed
Mfg.	R.M. Young
Model	18801
Serial No.	CAO1631

Comments: Wind speed was verified using a variable speed anemometer drive. The propellor was removed from the sensor and the drive was connected using a flexible connector. The sensor was then rotated in the appropriate direction at several different speeds. Sensor responses were taken from the data logger. No adjustments were made to the sensor.

# Inquest Environmental, Inc.

## Temperature Sensor Performance Audit

Operator The Doe Run Co  
 Location Big River  
 Station Name Meteorological System  
 Technician M Kunkel / C Boston

Date 10/29/2014  
 Start Time 11:15  
 Stop Time 12:30

### Sensor Information

Sensor Mfg Climatronics  
 Sensor Model NA  
 Serial Number NA  
 Sensor Height 2 meters

Audit Device °C	Sensor	
	Data Logger °C	Difference °C
0.0	0.2	0.2
17.7	17.9	0.2
35.1	35.4	0.3
Average		0.2

Note: The limit for each point is +/- 0.5 °C

Audit Device	
Type	Digital Thermometer
Mfg.	Control Company
Model	15-077-7
Serial No.	72415694

Comments: The temperature is verified by co-locating the sensor with a certified digital thermometer. The verification is conducted at three levels using two water baths (iced and hot water) and the ambient temperature.  
The sensor error was determined by comparing the sensor's data logger response to the display on the certified digital thermometer. No adjustments were made to the sensor.

# Inquest Environmental, Inc.

## Barometric Pressure Sensor Performance Audit

Operator The Doe Run Co  
Location Big River  
Station Name Meteorological System  
Technician M Kunkel / C Boston

Date 10/29/2014  
Start Time 11:15  
Stop Time 12:30

Sensor Mfg Setra  
Sensor Model 276  
Serial Number 2626447

Audit Device	Data Logger Response	
	BP mm HG	Difference mm HG
745.60	749.62	4.02

Note: Limit is +/- 7.5 mm HG.

Audit Device	
Type	Digital Barometer
Mfg.	AIR
Model	AIR-HB-1A
Serial No.	6G3745

Comments: The barometric pressure is verified by co-locating the sensor with a certified digital barometer. The verification was conducted at one level after allowing the sensor and calibration device ample time to stabilize.  
The sensor error was determined by comparing the sensor's data logger response to the display on the certified digital barometer. No adjustments were made to the sensor.

# Inquest Environmental, Inc.

## Precipitation Gauge Performance Audit

Operator The Doe Run Co  
Location Big River  
Station Name Meteorological System  
Technician M Kunkel / C Boston

Date 10/29/2014  
Start Time 11:15  
Stop Time 12:30

Sensor Mfg Texas Electronics  
Sensor Model TR525I  
Serial Number 36611-805  
Diameter (inches) 6.00

Audit Device Known Tips	Data Logger Response	
	Gauge Tips	Difference %
96.00	89.00	-7.29

Note: Limit is +/- 10%.

Audit Device	
Type	Graduated Beaker
Mfg.	Texas Instruments
Model	FC-525
Serial No.	NA

Comments: The precipitation gauge output was verified using a field calibration kit  
supplied by the manufacturer. The kit consists of a graduated beaker  
and a calibration funnel using a precision orifice at the water outlet.  
Water was measured in the beaker and poured into the funnel while  
mounted on the gauge. The amount of precipitation recorded by the  
data logger was then compared to the known amount of water passing  
through the funnel. 100 tips equals one inch of rainfall. The gauge  
was cleaned and no adjustments were made.

## **Meteorological Audit Devices Certifications**

# BRUNTON OUTDOOR GROUP

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## CERTIFICATE OF CALIBRATION

### Equipment Owner

Name: Environmental Atten: Mitchell Kunkel  
Address: 3609 Mojave Court Ste E  
Columbia, MO 65202

Calibration traceable to the National Institute of Standards and Technology in accordance with MIL-STD-45662A has been accomplished on the instrument listed below by comparison with standards maintained by the Brunton Outdoor Group. The accuracy and stability of all standards maintained by the Brunton Outdoor Group are traceable to national standards maintained by the National Institute of Standards and Technology in Washington, D.C. and Boulder, CO. Completed record of all work performed is maintained by the Brunton Outdoor Group and is available for inspection upon request.

This unit has been calibrated to Lietz TM10E serial number 30937 traceable to N.B.S. Number 738227675 this 16<sup>TH</sup> Day May 20 13.

Description Pocket Transit

Purchase Order RA 256426895

Order Number SO-042272

Model Number F-5008

Serial Number 5080304492

Calibration Date May 16, 2013

Recalibration Date May 16, 2014

Signed Patricia K. Shuster

Quality Control Coordinator





CALIBRATION PROCEDURE  
18801/18810 ANEMOMETER DRIVE

DWG: CP18801(A)

REV: C101107

PAGE: 2 of 3

BY: TJT

DATE: 10/11/07

CHK: JC

W.C. GAS-12

CERTIFICATE OF CALIBRATION AND TESTING

MODEL: 18801 (Comprised of Models 18820 Control Unit & 18830 Motor Assembly)  
SERIAL NUMBER: CA01631

R. M. Young Company certifies that the above equipment was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating the measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

Nominal Motor Rpm	Output Frequency Hz (1)	Calculated Rpm (2)	Indicated Rpm (3)
600	320	600	600
1200	640	1200	1200
2400	1280	2400	2400
4200	2240	4200	4200
6,000	3200	6000	6000
8,100	4320	8100	8100
9,900	5280	9900	9900
<input checked="" type="checkbox"/> Clockwise and Counterclockwise rotation verified			

- (1) Measured at the optical encoder output.  
(2) Frequency output produces 32 pulses per revolution of motor shaft.  
(3) Indicated on the Control Unit LCD display.

\* Indicates out of tolerance

☒ No Calibration Adjustments Required

☐ As Found

☐ As Left

Traceable frequency meter used in calibration Model: DP5740 SN: 4683

Date of inspection 15 Nov 2013  
Inspection Interval One Year

Tested By EC



Calibration complies with ISO/IEC  
17025, ANSI/NCCL Z540-1, and 9001



Cert. No.: 4000-5654260

### Traceable® Certificate of Calibration for Digital Thermometer

Cust ID: Inquest Environmental Inc., 3609 Mojave Ct. Suite E, Attn. Mitchell Kunkel, Columbia, MO 65202 U.S.A. (RMA:983601)

#### Instrument Identification:

Model Numbers: 15-077-8, FB50266, 245BY S/N: 21357521 Manufacturer: Control Company

Model: 15-077-7 S/N: 72415694

#### Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/13/14	1000332071
Temperature Probe	128	2/20/14	6-B4829-30-1
Temperature Calibration Bath TC-218	A73332		
Thermistor Module	A27129	10/25/14	1000346002
Temperature Probe	5202	11/30/14	15-B15PW-1-1
Temperature Calibration Bath TC-275	B16388		
Digital Thermometer	B16815	8/12/14	1000341967
PRT Temperature Probe	02022	8/14/15	B3812004

#### Certificate Information:

Technician: 68 Procedure: CAL-06  
Test Conditions: 24.5°C 32.0 %RH 1026 mBar

Cal Date: 1/17/14

Cal Due: 1/17/15

#### Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C	0.000	0.006	Y	0.000	0.000	Y	-0.050	0.050	0.013	3.8:1
°C	25.003	25.003	Y	25.003	24.999	Y	24.953	25.053	0.023	2.2:1
°C	60.000	59.988	Y	60.000	60.002	Y	59.950	60.050	0.014	3.6:1
°C	99.998	99.961	Y	99.998	100.000	Y	99.948	100.048	0.018	2.8:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min=As Left Nominal(Rounded) - Tolerance; Max=As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

*Nicol Rodriguez*  
Nicol Rodriguez, Quality Manager

*Aaron Judice*  
Aaron Judice, Technical Manager

#### Maintaining Accuracy:

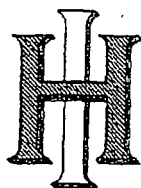
In our opinion once calibrated your Digital Thermometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Thermometers change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

#### Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA  
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.  
Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2006-AQ-HOU-RVA.  
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).



# HASS INSTRUMENT CORPORATION

6711 OLD BRANCH AVENUE • CAMP SPRINGS, MD 20748-6990 • (301) 449-5454 • FAX (301) 449-5455

## CALIBRATION REPORT

BAROMETER/ALTIMETER

AIR Model AIR-HB-1A

Serial No. 6G3745

TEST POINT	TEST PRESSURE	DIGITAL READOUT	READOUT ERROR	CORRECTION REQUIRED
1	930.00	931.9	+1.9	-1.9
2	970.00	971.9	+1.9	-1.9
3	1010.00	1012.0	+2.0	-2.0
4	1050.00	1051.9	+1.9	-1.9
5	1018.01	1019.9	+1.9	-1.9

### NOTES:

1. All data are in Millibars (hPa) and were taken at 75 F (24 C).
2. To correct the Digital Readout of the instrument, either algebraically add the CORRECTION REQUIRED to, or algebraically subtract the READOUT ERROR from, the readout shown on the instrument.
3. The TEST PRESSURE was generated using Type A-1 Barometer S/N 3327, and was approached in an increasing-pressure direction.
4. The TEST PRESSURE for TEST POINT 5 was ambient atmospheric pressure.
5. The BAROMETER/ALTIMETER was horizontal during the calibration.
6. The LCD screen of the BAROMETER/ALTIMETER has some trash in the center of the display, but it does not interfere with the readout.
7. Although the Digital Readout of the instrument can be adjusted to incorporate the average CORRECTION REQUIRED, this has not been done.

Calibration Date: 5 February 2014

By: Bernard I. Hass

Bernard I. Hass

(SEAL)